CLAIMS

WHAT IS CLAIMED IS:

1. A device for creating a three-dimensional profile of an object or scene being imaged, the device comprising:

a light source for illuminating said object or scene with a light pattern, wherein said light pattern has a characteristic that varies across said object or scene and that includes two or more sub-patterns;

an image sensor for imaging said object or scene as illuminated with said light pattern; and

a processor for calculating a distance to a point on said object or in said scene based on a baseline distance between said light source and said camera, an angle between said camera and said baseline, and an angle at which light striking the point is emitted by said light source as determined from the characteristic of the light striking the point.

2. The device of claim 1, wherein the varying characteristic is a spatially varying wavelength, and wherein two or more sub-patterns are two or more spectra of light in the visible light spectrum such that a given wavelength corresponds to more than one projection angle.

3. The device of claim 2, wherein the processor determines the projection angle for the given wavelength via adaptive initial point calculation, wherein the processor restricts a search space for color matching in one of said sub-patterns.

4. The device of claim 1, wherein the two or more sub-patterns are two or more spectra of light in the infrared light spectrum.

5. The device of claim 1, wherein the two or more sub-patterns are two or more spectra of light in the ultraviolet light spectrum.

6. The device of claim 1, wherein the varying characteristic is a spatially varying intensity, and wherein two or more sub-patterns are three light sub-patterns corresponding to red, green and blue components of the light pattern.

7. The device of claim 6, wherein said three light sub-patterns have varying intensities, each sub-pattern having a high point and a low point.

8. The device of claim 7, wherein the high points and low points for the three sub-patterns are distributed over a spatial period of the light pattern.

9. The device of claim 1, wherein the varying characteristic is a spatially varying wavelength, and wherein the device further comprises an optical filter coupled to the light source to generate said light pattern.

10. The device of claim 9, wherein said optical filter is a linear variable wavelength filter.

11. The device of claim 1, wherein the light pattern is pre-distorted based on a pre-calibration characteristic of the image sensor.

12. The device of claim 1, further comprising a second image sensor, wherein said image sensor and said second image sensor together form a stereo pair.

13. The device of claim 1, wherein the varying characteristic is a spatially varying intensity and wherein the image sensor is monochromic and the light source generates the light pattern by sequentially emitting a plurality of light sub-patterns.

14. The device of claim 13, wherein the plurality of light sub-patterns is three light sub-patterns corresponding to red, green and blue components of the light pattern.

15. The device of claim 1, wherein the varying characteristic is a spatially varying intensity and the device further comprises a planar member having a plurality of openings disposed between said light source and said object or scene for generating the light pattern.

16. The device of claim 15, wherein said plurality of openings are slots.

17. The device of claim 15, further comprising a microshifting mechanism coupled to the planar member to generate shifts of the light pattern by moving the planar member, wherein the processor calculates a distance to the point on the object or scene using triangulation based on the shifts of said light pattern.

18. The device of claim 17, wherein the microshifting mechanism includes a support structure coupled to the planar member, wherein the support structure is formed of a bimorpher material that is movable in response to an applied voltage to thereby move the planar member.

19. The device of claim 17, wherein the microshifting mechanism includes a support structure coupled to the planar member and an electromagnetic actuator to move the support structure and thereby move the planar member.

20. A device for creating a three-dimensional profile of an object or scene being imaged, the device comprising:

a light source for illuminating said object or scene with a light pattern, wherein said light pattern has a spatially varying characteristic that varies across said object or scene and includes two or more visible light spectra arranged contiguously with each other such that light having a given characteristic is emitted at two or more projection angles;

an image sensor for imaging said object or scene as illuminated with said light pattern; and

a processor for calculating a distance to a point on said object or in said scene based on a baseline distance between said light source and said camera, an angle between said camera and said baseline, and an angle at which light striking the point is emitted by said light source as determined from the given characteristic of the light striking the point.

21. The device of claim 20, wherein the spatially varying characteristic is wavelength, and wherein the processor selects from said two or more projection angles by correlating the point position with one of said two or more visible light spectra.

22. The device of claim 21, wherein the processor determines the projection angle for the given wavelength via adaptive initial point calculation, wherein the processor restricts a search space for color matching in one of said visible light spectra.

23. The device of claim 20, wherein the image sensor is pre-calibrated to generate a pre-distorted projection pattern.

24. The device of claim 20, further comprising a second image sensor, wherein said image sensor and said second image sensor together form a stereo pair.

25. The device of claim 20, wherein the spatially varying characteristic is wavelength, and wherein the device further comprises a planar member having a plurality of openings disposed between said light source and said object or scene for generating the light pattern.

26. The device of claim 25, further comprising a microshifting mechanism coupled to the planar member to generate shifts of the light pattern by moving the planar member, wherein the processor calculates a distance to the point on the object or scene using triangulation based on the shifts of said light pattern.

27. The device of claim 26, wherein the microshifting mechanism includes a support structure coupled to the planar member, wherein the support structure is formed of a bimorpher material that is movable in response to an applied voltage to thereby move the planar member.

28. The device of claim 26, wherein the microshifting mechanism includes a support structure coupled to the planar member and an electromagnetic actuator to move the support structure and thereby move the planar member.

29. A method for creating a three-dimensional profile of an object or scene being imaged, the method comprising the steps of:

illuminating the object or scene with a light pattern, wherein said light pattern has a spatially varying characteristic that varies across said object or scene and includes two or more sub-patterns;

imaging said object or scene as illuminated with said light pattern; and

calculating a distance to a point on said object or in said scene based on a baseline distance between said light source and said camera, an angle between said camera and said baseline, and an angle at which light striking the point is emitted by said light source as determined from the spatially varying characteristic of the light striking the point.

30. The method of claim 29, wherein the spatially varying characteristic is wavelength, and wherein the two or more sub-patterns are two or more spectra of light in the visible light spectrum such that a given wavelength corresponds to more than one projection angle.

31. The method of claim 30, wherein the calculating step includes the step of determining the projection angle for the given wavelength via adaptive initial point calculation by restricting a search space for coloring matching in one of said sub-patterns.

32. The method of claim 29, wherein the spatially varying characteristic is intensity, and wherein the two or more sub-patterns from the illuminating step are three light sub-patterns corresponding to red, green and blue components of the light pattern, and wherein the three light sub-patterns have varying intensities, each sub-pattern having a high point and a low point such that the high points and low points for the three sub-patterns are distributed over a spatial period of the light pattern.

33. The method of claim 29, further comprising the step of pre-distorting the light pattern based on a pre-calibration characteristic of the image sensor.

34. The method of claim 29, wherein the imaging step comprises the step of imaging the illuminated object or scene using at least two image sensors.

35. The method of claim 29, wherein the spatially varying characteristic is intensity, and wherein the illuminating step comprises the step of generating the light pattern by sequentially emitting a plurality of light sub-patterns corresponding to red, green and blue components of the light pattern.

36. The method of claim 29, further comprising the steps of shifting the light and calculating a distance to the point on the object or scene using triangulation based on the shifts of said light pattern.